



# Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 09:34 PM BST

PDB ID : 2JT8  
Title : Solution structure of the F153-to-5-fluorotryptophan mutant of human cardiac troponin C  
Authors : Wang, X.; Mercier, P.; Letourneau, P.; Sykes, B.D.  
Deposited on : 2007-07-20

This is a Full wwPDB NMR Structure Validation Report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/NMRValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

Cyrange : Kirchner and Güntert (2011)  
NmrClust : Kelley et al. (1996)  
MolProbity : 4.02b-467  
Mogul : 1.7.1 (RC1), CSD as537be (2016)  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
RCI : v\_1n\_11\_5\_13\_A (Berjanski et al., 2005)  
PANAV : Wang et al. (2010)  
ShiftChecker : rb-20027457  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20027457

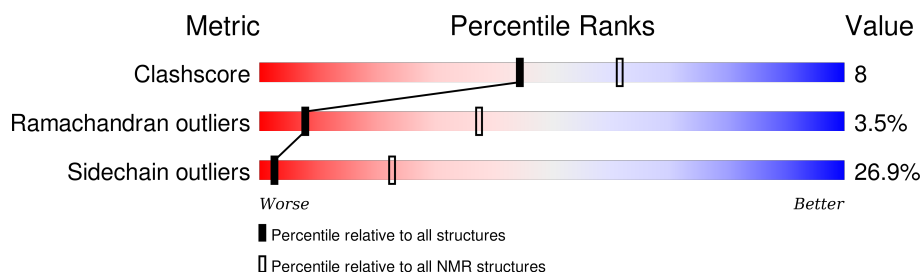
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*SOLUTION NMR*

The overall completeness of chemical shifts assignment is 78%.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	NMR archive (#Entries)
Clashscore	114402	11133
Ramachandran outliers	111179	9975
Sidechain outliers	111093	9958

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and a grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ .

Mol	Chain	Length	Quality of chain
1	A	161	 54% 34% • 11%

## 2 Ensemble composition and analysis ⓘ

This entry contains 10 models. Model 2 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *lowest energy*.

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	Residue range (total)	Backbone RMSD (Å)	Medoid model
1	A:3-A:82 (80)	2.37	2
2	A:94-A:152, A:154-A:158 (64)	0.61	7

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 3 clusters and 1 single-model cluster was found.

Cluster number	Models
1	1, 3, 6, 7, 9
2	2, 4
3	8, 10
Single-model clusters	5

### 3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 2495 atoms, of which 1211 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Troponin C, slow skeletal and cardiac muscles.

Mol	Chain	Residues	Atoms							Trace
1	A	161	Total	C	F	H	N	O	S	0
			2495	795	1	1211	197	280	11	

There are 3 discrepancies between the modelled and reference sequences:

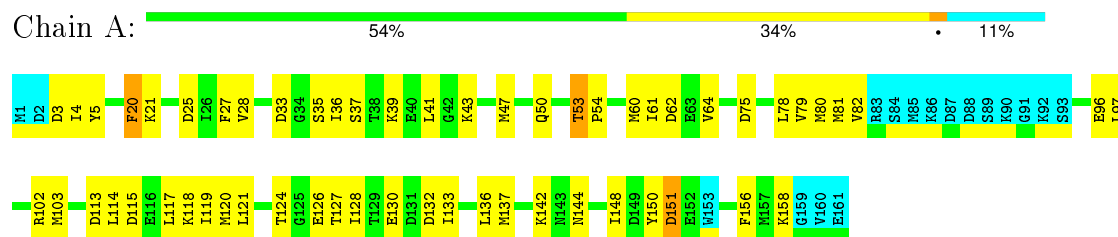
Chain	Residue	Modelled	Actual	Comment	Reference
A	35	SER	CYS	ENGINEERED	UNP P63316
A	84	SER	CYS	ENGINEERED	UNP P63316
A	153	FTR	PHE	ENGINEERED	UNP P63316

## 4 Residue-property plots

### 4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA and DNA chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

- Molecule 1: Troponin C, slow skeletal and cardiac muscles

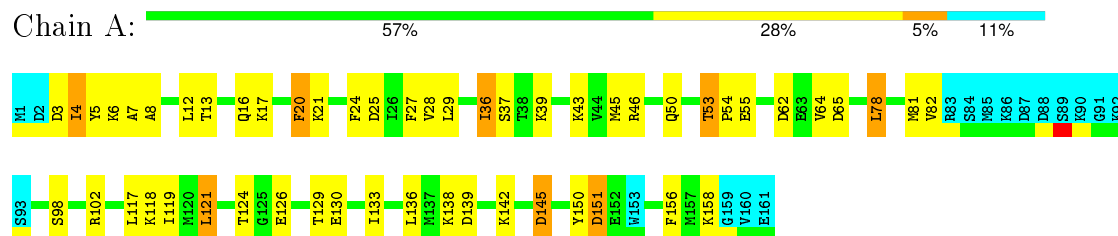


### 4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

#### 4.2.1 Score per residue for model 1

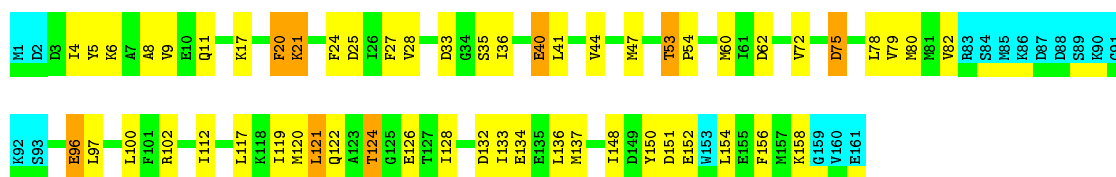
- Molecule 1: Troponin C, slow skeletal and cardiac muscles



#### 4.2.2 Score per residue for model 2 (medoid)

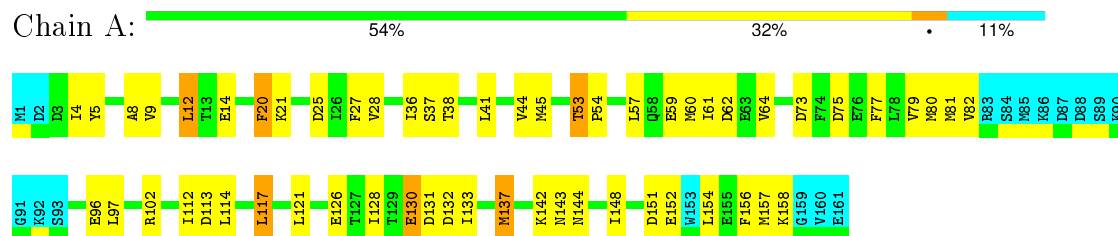
- Molecule 1: Troponin C, slow skeletal and cardiac muscles





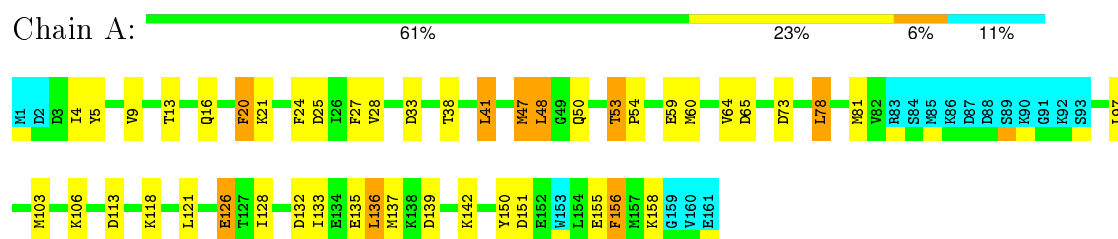
#### 4.2.3 Score per residue for model 3

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



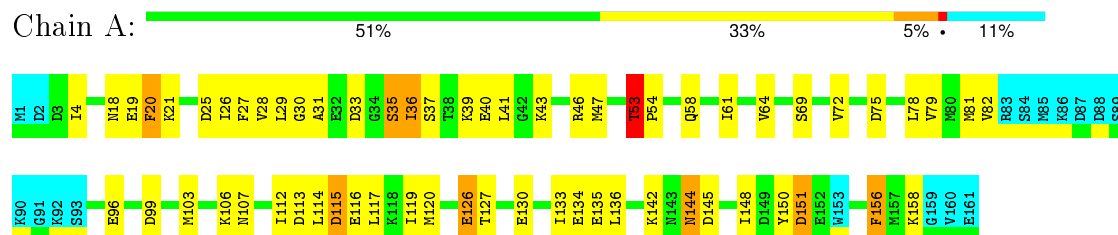
#### 4.2.4 Score per residue for model 4

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



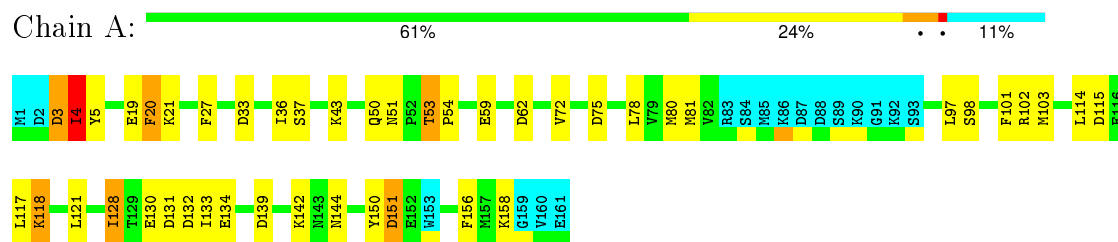
#### 4.2.5 Score per residue for model 5

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



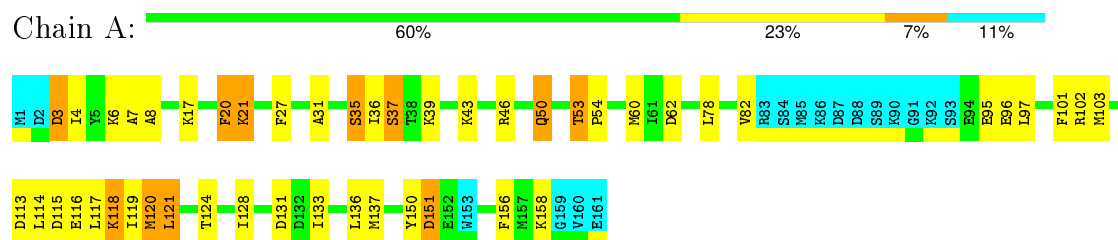
#### 4.2.6 Score per residue for model 6

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



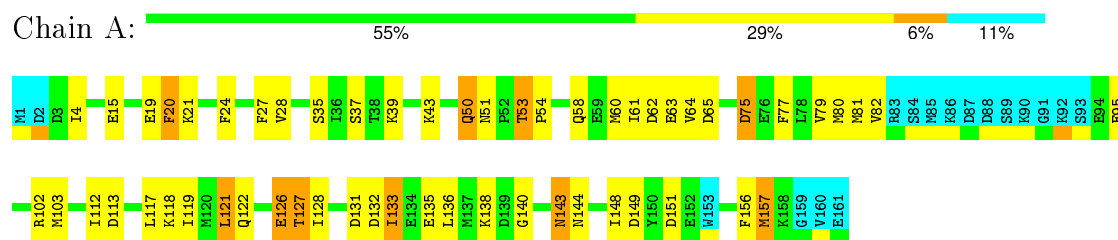
#### 4.2.7 Score per residue for model 7

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



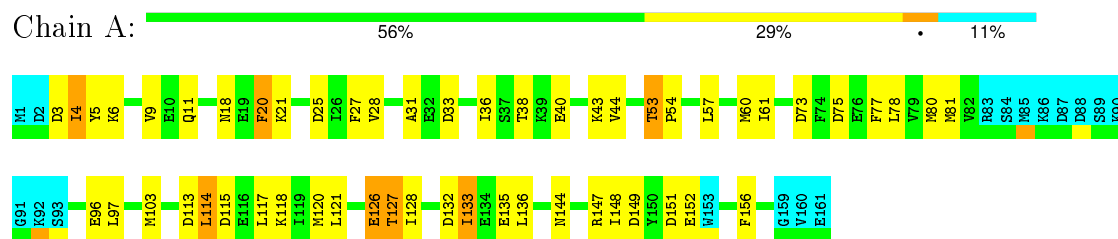
#### 4.2.8 Score per residue for model 8

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



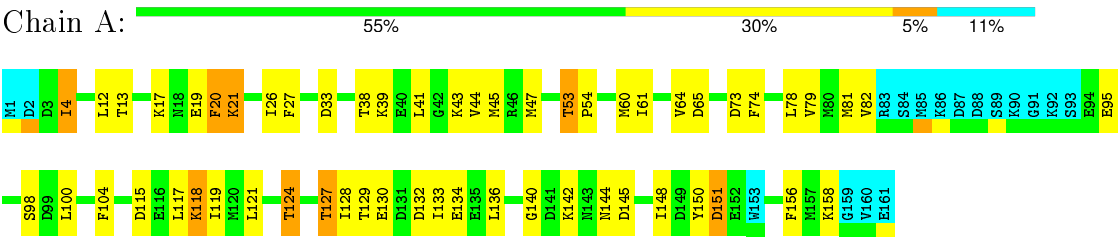
#### 4.2.9 Score per residue for model 9

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



4.2.10 Score per residue for model 10

- Molecule 1: Troponin C, slow skeletal and cardiac muscles





## 5 Refinement protocol and experimental data overview

The models were refined using the following method: *simulated annealing*.

Of the 50 calculated structures, 10 were deposited, based on the following criterion: *structures with the lowest energy*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
CYANA	structure solution	
CYANA	refinement	

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 7 of this report.

Chemical shift file(s)	BMRB entry 15400
Number of chemical shift lists	1
Total number of shifts	1526
Number of shifts mapped to atoms	1526
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	78%

No validations of the models with respect to experimental NMR restraints is performed at this time.

## 6 Model quality ⓘ

### 6.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: FTR

There are no covalent bond-length or bond-angle outliers.

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 6.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in each chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	1149	1084	1084	19±3
All	All	11490	10840	10840	186

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 8.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:121:LEU:HD13	1:A:128:ILE:HD11	1.03	1.30	10	1
1:A:41:LEU:HD22	1:A:41:LEU:C	0.70	2.06	4	1
1:A:114:LEU:HD12	1:A:115:ASP:N	0.68	2.04	9	2
1:A:4:ILE:HG22	1:A:5:TYR:CD1	0.64	2.27	6	1
1:A:140:GLY:O	1:A:148:ILE:HG23	0.63	1.94	8	1
1:A:115:ASP:O	1:A:119:ILE:HD12	0.62	1.94	10	1
1:A:5:TYR:O	1:A:9:VAL:HG23	0.62	1.94	4	4
1:A:35:SER:HB3	1:A:72:VAL:HG12	0.62	1.69	5	1
1:A:24:PHE:O	1:A:28:VAL:HG22	0.62	1.94	2	4
1:A:20:PHE:CZ	1:A:78:LEU:HD13	0.60	2.31	9	2
1:A:116:GLU:HA	1:A:119:ILE:HD12	0.60	1.74	5	2
1:A:121:LEU:CD2	1:A:133:ILE:HD13	0.60	2.27	1	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:61:ILE:O	1:A:64:VAL:HG22	0.59	1.97	5	1
1:A:3:ASP:C	1:A:4:ILE:HD13	0.59	2.18	9	1
1:A:8:ALA:HB2	1:A:82:VAL:HG11	0.59	1.73	7	1
1:A:121:LEU:O	1:A:124:THR:HG22	0.58	1.99	2	1
1:A:79:VAL:O	1:A:82:VAL:HG22	0.58	1.98	5	4
1:A:121:LEU:HD21	1:A:133:ILE:HG12	0.57	1.75	9	1
1:A:121:LEU:HD13	1:A:128:ILE:CG1	0.57	2.29	8	2
1:A:60:MET:O	1:A:64:VAL:HG13	0.57	1.99	4	1
1:A:130:GLU:O	1:A:133:ILE:HG22	0.57	2.00	1	4
1:A:106:LYS:HE3	1:A:119:ILE:HD13	0.56	1.77	5	1
1:A:26:ILE:O	1:A:29:LEU:HD22	0.56	2.01	5	1
1:A:61:ILE:O	1:A:64:VAL:HG12	0.56	2.00	10	3
1:A:118:LYS:HA	1:A:121:LEU:HD23	0.56	1.77	7	1
1:A:79:VAL:O	1:A:82:VAL:HG12	0.56	2.01	10	1
1:A:20:PHE:CE1	1:A:78:LEU:HD12	0.55	2.37	10	1
1:A:47:MET:C	1:A:48:LEU:HD13	0.54	2.23	4	1
1:A:117:LEU:HD12	1:A:133:ILE:HD11	0.54	1.77	3	1
1:A:75:ASP:O	1:A:79:VAL:HG23	0.53	2.02	8	3
1:A:21:LYS:CB	1:A:78:LEU:HD11	0.53	2.33	10	1
1:A:36:ILE:O	1:A:72:VAL:HG11	0.53	2.03	6	1
1:A:37:SER:CB	1:A:61:ILE:HG21	0.52	2.34	5	1
1:A:28:VAL:HG12	1:A:36:ILE:HG21	0.52	1.81	2	2
1:A:4:ILE:HG23	1:A:5:TYR:CD1	0.52	2.39	4	2
1:A:143:ASN:N	1:A:143:ASN:HD22	0.51	2.03	8	1
1:A:20:PHE:C	1:A:20:PHE:CD1	0.51	2.81	5	5
1:A:37:SER:HB3	1:A:61:ILE:HG21	0.51	1.82	5	1
1:A:21:LYS:HB2	1:A:78:LEU:HD11	0.51	1.80	10	1
1:A:12:LEU:HD21	1:A:16:GLN:OE1	0.51	2.06	1	1
1:A:20:PHE:CD1	1:A:20:PHE:C	0.50	2.84	6	5
1:A:12:LEU:HD11	1:A:16:GLN:OE1	0.50	2.07	1	1
1:A:117:LEU:HB2	1:A:133:ILE:HD11	0.50	1.83	6	1
1:A:100:LEU:HD12	1:A:104:PHE:CE2	0.50	2.42	10	1
1:A:117:LEU:CB	1:A:133:ILE:HD11	0.49	2.37	6	1
1:A:118:LYS:CB	1:A:133:ILE:HG21	0.49	2.36	1	1
1:A:28:VAL:CG1	1:A:36:ILE:HG21	0.49	2.37	2	2
1:A:12:LEU:HD11	1:A:17:LYS:CB	0.49	2.38	10	1
1:A:41:LEU:CD2	1:A:41:LEU:C	0.49	2.79	4	1
1:A:28:VAL:HG11	1:A:36:ILE:HG21	0.49	1.84	3	1
1:A:117:LEU:HD12	1:A:118:LYS:N	0.49	2.23	9	3
1:A:3:ASP:O	1:A:5:TYR:CG	0.48	2.65	9	1
1:A:8:ALA:CB	1:A:82:VAL:HG11	0.48	2.38	7	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:114:LEU:HA	1:A:117:LEU:HD12	0.48	1.85	6	3
1:A:40:GLU:O	1:A:44:VAL:HG23	0.48	2.08	2	1
1:A:8:ALA:HB2	1:A:82:VAL:HG12	0.48	1.84	3	1
1:A:117:LEU:CD1	1:A:133:ILE:HD11	0.48	2.38	10	1
1:A:3:ASP:O	1:A:4:ILE:CG1	0.48	2.62	7	1
1:A:74:PHE:O	1:A:78:LEU:HD23	0.48	2.09	10	1
1:A:4:ILE:N	1:A:4:ILE:HD13	0.48	2.24	10	1
1:A:126:GLU:O	1:A:127:THR:HG23	0.47	2.09	9	1
1:A:128:ILE:HD12	1:A:132:ASP:HB3	0.47	1.86	4	2
1:A:40:GLU:O	1:A:44:VAL:HG22	0.47	2.08	9	1
1:A:8:ALA:HB2	1:A:82:VAL:CG2	0.47	2.39	1	1
1:A:41:LEU:HD22	1:A:41:LEU:O	0.47	2.10	4	1
1:A:118:LYS:NZ	1:A:133:ILE:HG21	0.47	2.24	6	1
1:A:112:ILE:HG21	1:A:117:LEU:HD21	0.47	1.86	5	1
1:A:12:LEU:HD11	1:A:17:LYS:HB2	0.46	1.86	10	1
1:A:40:GLU:O	1:A:44:VAL:HG13	0.46	2.10	9	1
1:A:53:THR:N	1:A:54:PRO:HD2	0.46	2.26	10	10
1:A:57:LEU:O	1:A:61:ILE:HG23	0.46	2.10	9	1
1:A:121:LEU:HD13	1:A:126:GLU:HB2	0.46	1.88	4	1
1:A:20:PHE:CZ	1:A:78:LEU:HD12	0.46	2.45	4	1
1:A:24:PHE:CE1	1:A:28:VAL:HG11	0.46	2.46	2	1
1:A:13:THR:HG22	1:A:16:GLN:OE1	0.46	2.11	4	1
1:A:112:ILE:CG2	1:A:117:LEU:HD21	0.45	2.41	5	1
1:A:12:LEU:HD12	1:A:13:THR:N	0.45	2.26	1	1
1:A:8:ALA:HB3	1:A:82:VAL:HG12	0.45	1.89	2	1
1:A:117:LEU:CD1	1:A:133:ILE:HD12	0.45	2.40	8	1
1:A:3:ASP:O	1:A:4:ILE:HG12	0.45	2.12	9	1
1:A:41:LEU:O	1:A:44:VAL:HG12	0.45	2.12	3	1
1:A:120:MET:O	1:A:124:THR:HG23	0.45	2.11	7	1
1:A:8:ALA:HB3	1:A:82:VAL:CG1	0.45	2.41	2	1
1:A:117:LEU:HD21	1:A:137:MET:HG3	0.45	1.89	3	1
1:A:96:GLU:O	1:A:100:LEU:HD13	0.45	2.11	2	1
1:A:41:LEU:HD21	1:A:61:ILE:HG21	0.44	1.89	10	1
1:A:3:ASP:O	1:A:4:ILE:HG13	0.44	2.13	7	1
1:A:121:LEU:HD13	1:A:128:ILE:HG13	0.44	1.87	8	1
1:A:29:LEU:HD23	1:A:30:GLY:H	0.43	1.73	5	1
1:A:97:LEU:HD23	1:A:154:LEU:HA	0.43	1.89	2	1
1:A:140:GLY:HA3	1:A:148:ILE:HD11	0.43	1.90	10	1
1:A:136:LEU:HD23	1:A:156:PHE:CE1	0.43	2.49	4	1
1:A:28:VAL:HG12	1:A:36:ILE:CG2	0.43	2.43	1	1
1:A:53:THR:HG22	1:A:54:PRO:N	0.42	2.29	1	10

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:121:LEU:HD23	1:A:133:ILE:HD13	0.42	1.91	1	1
1:A:53:THR:CB	1:A:54:PRO:CD	0.42	2.97	6	10
1:A:12:LEU:HD21	1:A:17:LYS:HD2	0.42	1.90	10	1
1:A:112:ILE:HB	1:A:148:ILE:HD12	0.42	1.91	3	4
1:A:41:LEU:O	1:A:44:VAL:HG22	0.42	2.13	10	1
1:A:4:ILE:CG2	1:A:5:TYR:CD1	0.42	3.00	6	1
1:A:28:VAL:HB	1:A:31:ALA:HB3	0.42	1.91	9	1
1:A:20:PHE:CD1	1:A:21:LYS:N	0.42	2.88	7	3
1:A:148:ILE:HD13	1:A:156:PHE:CE2	0.42	2.50	5	1
1:A:118:LYS:HG3	1:A:133:ILE:HD12	0.41	1.91	10	1
1:A:28:VAL:HG12	1:A:36:ILE:HG23	0.41	1.90	1	1
1:A:31:ALA:HB1	1:A:35:SER:N	0.41	2.30	7	1
1:A:72:VAL:O	1:A:72:VAL:HG13	0.41	2.15	5	1
1:A:28:VAL:HB	1:A:36:ILE:HD13	0.41	1.93	5	1
1:A:29:LEU:HD23	1:A:30:GLY:N	0.41	2.31	5	1
1:A:9:VAL:HA	1:A:12:LEU:HD23	0.41	1.92	3	1
1:A:97:LEU:HD23	1:A:154:LEU:HD22	0.41	1.93	3	1
1:A:4:ILE:CG2	1:A:5:TYR:N	0.41	2.83	6	1
1:A:4:ILE:HG23	1:A:5:TYR:CE1	0.41	2.51	4	1
1:A:3:ASP:O	1:A:4:ILE:CB	0.41	2.69	6	1
1:A:118:LYS:HB2	1:A:133:ILE:HG21	0.41	1.93	1	1
1:A:5:TYR:CD1	1:A:82:VAL:HG21	0.40	2.51	2	1
1:A:117:LEU:HB3	1:A:136:LEU:HD22	0.40	1.92	5	1
1:A:114:LEU:HD23	1:A:137:MET:HG3	0.40	1.94	3	1

## 6.3 Torsion angles ⓘ

### 6.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all NMR entries. The Analysed column shows the number of residues for which the backbone conformation was analysed and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	144/161 (89%)	125±3 (87±2%)	14±3 (9±2%)	5±2 (4±1%)	8	37
All	All	1440/1610 (89%)	1254 (87%)	135 (9%)	51 (4%)	8	37

All 16 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	53	THR	10
1	A	151	ASP	8
1	A	126	GLU	6
1	A	50	GLN	4
1	A	144	ASN	4
1	A	124	THR	3
1	A	127	THR	3
1	A	158	LYS	2
1	A	37	SER	2
1	A	39	LYS	2
1	A	4	ILE	2
1	A	143	ASN	1
1	A	36	ILE	1
1	A	31	ALA	1
1	A	142	LYS	1
1	A	145	ASP	1

### 6.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all NMR entries. The Analysed column shows the number of residues for which the sidechain conformation was analysed and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	127/141 (90%)	93±3 (73±3%)	34±3 (27±3%)	2	23
All	All	1270/1410 (90%)	928 (73%)	342 (27%)	2	23

All 96 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	20	PHE	10
1	A	27	PHE	10
1	A	156	PHE	10
1	A	21	LYS	10
1	A	81	MET	8
1	A	150	TYR	7
1	A	43	LYS	7
1	A	151	ASP	7
1	A	4	ILE	7
1	A	136	LEU	7

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Mol	Chain	Res	Type	Models (Total)
1	A	33	ASP	6
1	A	60	MET	6
1	A	62	ASP	6
1	A	158	LYS	6
1	A	133	ILE	6
1	A	113	ASP	6
1	A	25	ASP	6
1	A	78	LEU	6
1	A	103	MET	6
1	A	102	ARG	6
1	A	121	LEU	5
1	A	96	GLU	5
1	A	80	MET	5
1	A	75	ASP	5
1	A	132	ASP	5
1	A	142	LYS	5
1	A	37	SER	4
1	A	47	MET	4
1	A	134	GLU	4
1	A	73	ASP	4
1	A	120	MET	4
1	A	137	MET	4
1	A	6	LYS	4
1	A	135	GLU	4
1	A	131	ASP	4
1	A	128	ILE	4
1	A	19	GLU	4
1	A	65	ASP	4
1	A	118	LYS	4
1	A	35	SER	4
1	A	38	THR	4
1	A	50	GLN	3
1	A	126	GLU	3
1	A	145	ASP	3
1	A	98	SER	3
1	A	127	THR	3
1	A	77	PHE	3
1	A	97	LEU	3
1	A	45	MET	3
1	A	46	ARG	3
1	A	119	ILE	3
1	A	3	ASP	3

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Mol	Chain	Res	Type	Models (Total)
1	A	144	ASN	3
1	A	39	LYS	3
1	A	95	GLU	3
1	A	41	LEU	3
1	A	152	GLU	3
1	A	139	ASP	3
1	A	17	LYS	3
1	A	59	GLU	3
1	A	115	ASP	3
1	A	11	GLN	2
1	A	58	GLN	2
1	A	101	PHE	2
1	A	122	GLN	2
1	A	149	ASP	2
1	A	40	GLU	2
1	A	130	GLU	2
1	A	51	ASN	2
1	A	36	ILE	2
1	A	129	THR	2
1	A	157	MET	2
1	A	138	LYS	2
1	A	117	LEU	2
1	A	18	ASN	2
1	A	106	LYS	1
1	A	147	ARG	1
1	A	53	THR	1
1	A	55	GLU	1
1	A	72	VAL	1
1	A	13	THR	1
1	A	29	LEU	1
1	A	124	THR	1
1	A	15	GLU	1
1	A	114	LEU	1
1	A	69	SER	1
1	A	107	ASN	1
1	A	143	ASN	1
1	A	99	ASP	1
1	A	63	GLU	1
1	A	14	GLU	1
1	A	48	LEU	1
1	A	26	ILE	1
1	A	57	LEU	1

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Mol	Chain	Res	Type	Models (Total)
1	A	155	GLU	1
1	A	12	LEU	1

### 6.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 6.4 Non-standard residues in protein, DNA, RNA chains ⓘ

1 non-standard protein/DNA/RNA residue is modelled in this entry.

In the following table, the Counts columns list the number of bonds for which Mogul statistics could be retrieved, the number of bonds that are observed in the model and the number of bonds that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length is the number of standard deviations the observed value is removed from the expected value. A bond length with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond lengths.

Mol	Type	Chain	Res	Link	Bond lengths		
					Counts	RMSZ	#Z>2
1	FTR	A	153	1	12,16,17	3.50±0.01	1±0 (8±0%)

In the following table, the Counts columns list the number of angles for which Mogul statistics could be retrieved, the number of angles that are observed in the model and the number of angles that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond angle is the number of standard deviations the observed value is removed from the expected value. A bond angle with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond angles.

Mol	Type	Chain	Res	Link	Bond angles		
					Counts	RMSZ	#Z>2
1	FTR	A	153	1	13,22,24	1.01±0.01	0±0 (0±0%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	FTR	A	153	1	-	0±0,3,6,8	0±0,2,2,2

All unique bond outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	153	FTR	F-CZ3	11.83	1.08	1.36	7	10

There are no bond-angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 6.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 6.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 6.7 Other polymers [i](#)

There are no such molecules in this entry.

## 6.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 7 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 78% for the well-defined parts and 77% for the entire structure.

### 7.1 Chemical shift list 1

File name: BMRB entry 15400

Chemical shift list name: *assigned\_chem\_shift\_list\_1*

#### 7.1.1 Bookkeeping

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	1526
Number of shifts mapped to atoms	1526
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

#### 7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction $\pm$ precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	155	$-0.09 \pm 0.05$	None needed ( $< 0.5$ ppm)
$^{13}\text{C}_\beta$	143	$0.15 \pm 0.06$	None needed ( $< 0.5$ ppm)
$^{13}\text{C}'$	0	—	—
$^{15}\text{N}$	151	$0.52 \pm 0.22$	Should be applied

#### 7.1.3 Completeness of resonance assignments

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 78%, i.e. 1357 atoms were assigned a chemical shift out of a possible 1732. 20 out of 20 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	$^1\text{H}$	$^{13}\text{C}$	$^{15}\text{N}$
Backbone	557/716 (78%)	280/286 (98%)	141/288 (49%)	136/142 (96%)
Sidechain	750/920 (82%)	460/530 (87%)	290/361 (80%)	0/29 (0%)

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	Total	<sup>1</sup> H	<sup>13</sup> C	<sup>15</sup> N
Aromatic	50/96 (52%)	26/52 (50%)	24/44 (55%)	0/0 (—%)
Overall	1357/1732 (78%)	766/868 (88%)	455/693 (66%)	136/171 (80%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 77%, i.e. 1485 atoms were assigned a chemical shift out of a possible 1919. 21 out of 21 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	<sup>1</sup> H	<sup>13</sup> C	<sup>15</sup> N
Backbone	612/796 (77%)	307/318 (97%)	155/320 (48%)	150/158 (95%)
Sidechain	823/1027 (80%)	507/594 (85%)	316/398 (79%)	0/35 (0%)
Aromatic	50/96 (52%)	26/52 (50%)	24/44 (55%)	0/0 (—%)
Overall	1485/1919 (77%)	840/964 (87%)	495/762 (65%)	150/193 (78%)

#### 7.1.4 Statistically unusual chemical shifts [i](#)

There are no statistically unusual chemical shifts.

#### 7.1.5 Random Coil Index (RCI) plots [i](#)

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition.

Random coil index (RCI) for chain A:

